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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: David H. Blount

Serial No.: 09/754,580

Filed: 01/05/01

For: PRODUCTION OF CARBOHYDRATES AND ALCOHOL FROM BIOMASS

Examiner: Ganapathy Krishnan

Art Unit: 1623

AMENDMENT

Commissioner for Patents

United States Patent and Trademark Office

P.O. box 1450

Alexandria, VA 22313-1450

Sir:

In response to Office Action Paper, dated 12/28/04, please amend the above identified

Application as follows:

Claims:

1. (Cancel) The compounds, lignin, lignin-cellulose resinous compounds, carbon dioxide, and carbohydrates, produced from biomass by the process consisting of mixing, heating and reacting the components by the following steps:

- (1) preparation of biomass:

- excess water is removed from the biomass and ground or chipped into small pieces and utilized in the amount of 100 parts by weight;

- (2) add aqueous alkali metal hydroxide:

- aqueous solution of alkali metal hydroxide containing 20 to 40 parts by weight of alkali metal hydroxide is added and mixed with the biomass:

- (3) converting biomass:

- the biomass is heated to about 140° C to evaporate water and break the lignin-cellulose bond then heating is continued while agitating until the biomass becomes a thick paste;

- (4) dissolving converted biomass:

- water in the amount of 200 to 400 parts by weight is added and mixed with the converted biomass thereby dissolving most of the converted biomass, then filtering or decanted off the non-water soluble biomass;

- (5) adjusting the pH:

- an acidic salt forming compound, carbon dioxide is added to the aqueous converted biomass solution until the pH is 3-7;

- (6) separating the components;

the lignin-cellulose resinous products are skimmed from the top of the aqueous solution, the aqueous solution containing carbohydrates and salt is filter or decanted off the precipitated lignin;

(7) crystalizing carbohydrates:

the aqueous carbohydrates and salt solution is heated to evaporate water to concentrate the solution then the carbohydrates are crystalized and precipitate out then the aqueous salt solution is filtered or decanted off;

(8) recausticing:

the aqueous solution containing the salts of step 7 is heated to evaporate excess water then placed in a furnace, with or without lignin, burned to remove organic waste material, then added to water, filtered, then reacted with and alkaline earth metal oxide, to produce alkali metal hydroxide for reuse and alkaline earth metal carbonate which precipitates;

(9) alkaline earth metal is heated in a lime kiln to produce alkali earth metal oxide for reuse and carbon dioxide is collected.

2. (Cancel) The compounds of claim 1 wherein the alkali metal hydroxide is sodium hydroxide.
3. (cancel) The compound of claim 1 wherein the alkaline earth metal oxide is calcium oxide,
4. (Canceled) The compounds of claim 1 wherein the carbohydrates are crystalized out of the aqueous solution of step 4 of claim 1 then fermented by yeast into ethanol.
5. (cancel) The compounds of claim 1 wherein the carbohydrates are separated from the lignin and salt after step 6, by means of membrane technology.
6. (Previously amended) The process for production of the compounds, lignin, lignin-

cellulose resinous compounds, carbon dioxide, and carbohydrates produced from biomass by the process consisting of mixing, heating, and reacting the components by the following steps:

(1) preparation of biomass:

excess water is removed from the biomass and ground or chipped into small pieces and utilized in the amount of 100 parts by weight;

(2) adding aqueous alkali metal hydroxide:

aqueous solution of alkali metal hydroxide containing 25 to 50 parts by weight of alkali metal hydroxide is added and mixed with the biomass;

(3) converting biomass:

the biomass is heated to about 140° C to evaporate the water and break the lignin-cellulose bond then heating is continued while agitating and the biomass becomes a thick paste;

(4) dissolving converted biomass:

water in the amount of 200 to 400 parts by weight is added and mixed with the converted biomass thereby dissolving most of the converted biomass, then filtered or decanted off the non-water soluble biomass;

(5) adjusting the pH:

an acidic salt forming compound, carbon dioxide, is added to the aqueous converted biomass solution until the pH is 3-7;

(6) separating the components:

the lignin-cellulose resinous products are skimmed from the top of the aqueous solution then the aqueous solution containing the carbohydrates and salt is filtered or

decanted off the precipitated lignin;

(7) crystalizing carbohydrates:

the aqueous carbohydrates and salt solution is heated to evaporate water to concentrate the solution, then the carbohydrates are precipitated out, and the aqueous salt solution is filtered or decanted off;

(8) recausticing:

the aqueous solution containing salts is heated to evaporate excess water then placed in a furnace, with or without lignin, burned to remove organic material, then added to water, filtered, then reacted with an alkaline earth metal oxide, to produce alkali metal hydroxide for reuse and alkaline earth metal salt which precipitates;

(9) alkaline earth metal oxide recovery:

the alkaline earth metal salt is heated in a lime kiln to produce alkaline earth metal oxide and carbon dioxide for reuse.

7. (Cancel) The product, carbohydrates, as produced by the process of claim 7.
8. (Original) The process of claim 6 wherein the alkali metal hydroxide is sodium hydroxide.
9. (cancel) The process of claim wherein the salt forming compound is carbon dioxide.
10. (Canceled) The product, ethanol, as produced by the process of claim 6.
11. (cancel) The product, lignin, as produced by the process of claim 6.
12. (cancel) The product lignin-cellulose resinous products, as produced by the process of claim 6.
13. (cancel) The carbohydrates produced from biomass by the process consisting of mixing, heating and reacting by the following steps:

- (1) biomass is ground into small particles;
 - (2) aqueous sodium hydroxide is added to and mixed with the biomass;
 - (3) biomass is heated to remove excess water;
 - (4) biomass is heated to 140° to 200° C until the biomass swells and forms a thick fluid mass, carbon dioxide is given off and collected, thereby producing a mixture of hemi-cellulose, carbohydrates, -modified- sodium lignin, lignin-cellulose resinous products and sodium carbonate;
 - (5) water is added and mixed to form a concentrated aqueous solution
 - (6) carbon dioxide is added and mixed with the aqueous solution to react with the sodium hydroxide to form sodium carbonate;
 - (7) carbohydrates form crystals and the aqueous solution is filtered off thereby recovering the carbohydrates;
 - (8) the aqueous solution containing the -modified- sodium lignin, lignin-cellulose resinous products and sodium carbonate is evaporated, and the solid materials are burned in a furnace, the water is added to recover the sodium carbonate;
 - (9) lime oxide is added and reacted with the sodium carbonate to form sodium hydroxide and calcium carbonate which precipitates, and aqueous hydroxide is decanted off to be reused;
 - (10) calcium carbonate is heated in a lime kiln to recover calcium oxide for reuse and the carbon dioxide is collected for reuse.
14. (Canceled) The carbohydrates of claim 13 wherein water is added in an amount to produce a solution containing 15 to 20 percent carbohydrates, then yeast is added to the solution to

ferment the carbohydrates to form ethanol.

15. (Canceled) The product, ethanol, produced by the process of claim 14.